

\*Thomasville and 65° at Atlanta to 104° at Augusta and 105° at \*Thomasville. *Florida*—68° to 104° at Jacksonville. *Alabama*—67° at \*Wilsonville and 71° at Mobile to 101° at Montgomery and \*Wilsonville. *Mississippi*—68° at Vicksburg to 98° at Vicksburg and 102° at \*Brookhaven. *Louisiana*—67° to 100° at Shreveport. *Texas*—59° at Fort Davis to 109° at Graham. *Ohio*—53° at \*Westerville to 98° at Cincinnati and 100° at \*Jacksonburg. *Kentucky*—63° to 98° at Louisville. *Tennessee*—64° at Knoxville to 101° at Chattanooga and Nashville. *Arkansas*—66° at \*Mount Ida and 67° at Little Rock to 100° at \*Mount Ida and Little Rock. *Michigan*—48° at Alpena to 93° at Marquette and 96° at \*Niles and \*Thornville. *Indiana*—55° at \*Spiceland and 58° at Indianapolis to 96° at Indianapolis and 100° at \*Veray. *Illinois*—58° to 101° at Springfield. *Missouri*—55° at \*Kansas City and 62° at St. Louis to 100° at St. Louis. *Kansas*—61° at Leavenworth to 97° at Leavenworth and 105° at \*Independence and \*Wellington. *Wisconsin*—50° at \*Neillsville and 53° at Milwaukee to 93° at Madison. *Iowa*—55° at Des Moines and \*Muscatine to 98° at Keokuk and 102° at \*Boonesboro. *Nebraska*—53° to 99° at North Platte. *Indian Territory*—67° at Fort Sill and Fort Gibson to 109° at Fort Gibson. *Minnesota*—49° at Duluth to 92° at St. Paul. *Dakota*—44° at Deadwood to 98° at Yankton and 102° at \*Olivet. *Colorado*—33° at \*Summit to 98° at \*Hermosa and Denver. *New Mexico*—47° at Santa Fe to 104° at La Mesilla. *Wyoming*—38° at \*Fort Fred Steele and 42° at Cheyenne to 95 at Cheyenne and 101° at \*Fort Fred Steele. *Montana*—43° to 86° at Virginia City. *Utah*—55° at Salt Lake City to 97° at Salt Lake City and 99° at \*Kanab. *Nevada*—39° at Winnemucca to 97° at Winnemucca and 102° at \*Fort McDermit. *Arizona*—41° at Fort Apache to 116° at Florence, Yuma and \*Texas Hill. *Idaho*—43° to 100° at Boise City. *California*—45° at \*Calistoga and 51° at San Francisco to 110° at Red Bluff and 119° at \*Mammoth Tank. *Oregon*—40° to 96° at Roseburg.

\*Those marked with a • are voluntary reports.

*Ranges of Temperature at Signal Service Stations.*—The monthly ranges will appear from an examination of the minima and maxima just given. Greatest daily ranges vary in New England from 20° at Wood's Holl and Mount Washington to 32° at Thatcher's Island; Middle Atlantic States, 16° at Cape May to 34° at Norfolk; South Atlantic States, 14° at Cape Lookout to 29° at Augusta; Gulf States, 14° at Key West to 28° at Shreveport and Corsicana; Ohio valley and Tennessee, 19° at Cairo to 32° at Pittsburgh; Lower Lake region, 24° at Erie to 31° at Oswego; Upper Lake region, 23° at Chicago, Grand Haven and Milwaukee to 33° at Marquette; the Northwest, 23° at Davenport, La Crosse and Omaha to 36° at Pembina and Fort Stevenson; Eastern Slope, 27° at Eagle Pass and San Antonio to 45° at Pilot Point; Rocky Mountain stations, 30° at Pike's Peak to 42° at Cheyenne; Western Plateau, 32° at Salt Lake City to 45° at Winnemucca; California, 17° at San Diego to 45° at Visalia; Oregon, 30° at Portland to 35° at Roseburg.

*Frost.*—1st, at Springfield, Mass., Niles, Starkey, N. Y.; 5th, at Scott Valley, Cal., heavy, killing vegetation; Fall River, on low ground, and Westport, Mass., 6th; sharp frost in Magdalen Islands, Gulf of St. Lawrence; Summit, Col., nearly every night during month.

*Ice.*—5th, at Yreka, Cal.

## PRECIPITATION.

*General Notes on Precipitation of Month.*—The general distribution of rain-fall for the month is illustrated as accurately as possible on chart No. III by returns from about 500 stations. In the lower left-hand corner of the chart will be found a table giving the average precipitation for July by districts. In general, the rain-fall for the first half of the month was deficient; serious droughts being reported in Texas, Nevada, Utah and the Middle and South Atlantic States and Tennessee. The extensive precipitation of the latter part of the month somewhat remedied the condition of Tennessee and the Middle and South Atlantic States but has not materially improved the condition of the other States, where numerous droughts were reported as prevailing at the end of the month. The excess of precipitation has been greatest in Oregon, Minnesota, Upper Missouri valley and Eastern Gulf States. Marked deficiencies are reported from the Western Gulf States and Ohio valley, and trifling ones from the Middle Atlantic States, Lower Missouri valley and California. Moderate amounts, in excess, have fallen in other districts. The month is remarkable for the number of sudden and heavy rains reported.

*Specially Heavy Rains.*—1st, Leavenworth, Kan., 1.51 inches in 8 hours. 2nd, Okalooska, La., 2.05 in 3 hours 30 minutes; St. Paul, Minn., 4.93 in 8 hours 30 minutes. 3rd, Fort Snelling, Minn., 6.60 in 25 hours; Mobile, Ala., 1.60 in 2 hours; Alpena, Mich., 1.47 in 2 hours. 4th, New Orleans, La., 1.37 in 3 hours 40 minutes. 6th, Chicago, Ill., 1.15 in 1 hour 45 minutes. 7th, Madison, Wis., 3.70 in 24 hours, of which 1.18 fell in 1 hour 45 minutes; La Crosse, Wis., 5.15 in 30 hours; Dubuque, Iowa, 2.85 in 8 hours; Logansport, Ind., 3.50 in 30 minutes; at Mound City, Mo., 10 inches is "reported" during a storm of about 36 hours; no authority given. 8th, Hinsdale, Ill., 3.75; Columbus, Ohio, 0.96 in 2 hours. 9th, Davenport, Iowa, 3.11 in 10 hours; Dubuque, Iowa, 2.52 in 6 hours 30 minutes; Monticello, Iowa, 5.60 in 24 hours; Sidney, Neb., 2.18 in 2 hours 45 minutes. 10th, Breckenridge, Minn., 1.59 in 3 hours; Duluth, Minn., 1.32 in 4 hours; Urbana, Ohio, nearly 2.00 in 25 minutes; Hudson, Ohio, 3.00 on 10th and 11th; Cleveland, Ohio, 3.86 in 24 hours, of which 3.30 fell in 7 hours 35 minutes; greatest amount in same time for 25 years. 11th, Sandusky, Ohio, 2.30 in 9 hours; Toledo, Ohio, 0.73 in 1 hour 15 minutes; Norwalk, Ohio, 1.04 in 1 hour; Cleveland, Ohio, 3.30 in 6 hours 35 minutes, of which 1.24 fell in 1 hour 5 min. 12th, New London, Conn., 1.44 in 8 hours; New Haven, 3.00 in 8 hours. 14th, Smithville, N. C., 1.65 in 8 hours; Thomasville, Ga., 2.18 inches in 6 hours. 15th, Yankton, Dak., 3.11 in 3 hours 55 minutes. 16th, New London, Conn., 1.73 in 5 hours 40 minutes; New Haven, 1.69 in 2 hours; Newport, R. I., 1.20 in 6 hours 20

minutes; North Platte, 1.36 in 2 hours; Fort Barrancas, Fla., 3.09; Fort Independence, 1.24 in 15 minutes; Amherst, Mass., 2.00 in 20 minutes; Dodge City, Kan., 1.94 in 5 hours. 19th, Fort Gibson, I. T., 1.16 in 4 hours 22 minutes; New Orleans, La., 1.28 in 1 hour 35 minutes; Mobile, 1.43 in 2 hours 30 minutes; Anna, Ill., 2.06 in 2 hours 45 minutes. 21st, North Platte, 1.57 in 3 hours 30 minutes; Fort Barrancas, Fla., 1.80 and 2.43 on 23rd; Litchfield, Penn., 1 inch in 40 minutes; Columbus, Ohio, 0.67 in 30 minutes. 24th, Brookhaven, Miss., 1.90 in.; Mobile, Ala., 1.80 in 1 hour; Smithville, N. C., 4.98 in less than 14 hours; Nashville, Tenn., 5.04 in 24 hours of which 3.30 fell in 4 hours 50 minutes. 26th, Ft. Preble, Me., 3.02 in.; Flushing, N. Y., 1 in hour; Trenton, N. J., 2.09 in 3 to 4 hours; Washington, D. C., 1.73 in 1 hour 15 minutes; Morgantown, 1.50 in 1 hour; Wilmington, N. C., 1.35 in 6 hours; Holmesville, Penn., 3.50 in 1 hour 15 minutes, "heaviest ever known." 27th, Portland, Me., 1.80 in about 6 hours; Pittsburgh, Penn., 1.05 in 1 hour 15 minutes; Fort Barrancas, Fla., 2.37 in. 28th, Shreveport, 1.21 in 5 hours; Ft. Wallace, Kan., 1.60 in 1 hour; Fayetteville, N. C., 3.50 in. followed by 6.50 on the 29th. 30th, Charlotte, N. C., 4.25 in 40 minutes; Fort Monroe, 2.18 in. 31st, New Orleans, La., 1.31 in 7 hours 30 minutes; Cape Henry, Va., 4.25 in less than 24 hours.

*Largest Monthly Rain-falls.*—Fort Barrancas, Fla., 18.32 inches; Fayetteville, N. C., 17.50; Mobile, Ala., 11.17; Duluth, Minn., 10.42; Mount Washington, N. H., 10.23; Smithville, N. C., 10.21; Sterling, Ill., 9.90; St. Marks, Fla., 9.82; Fort Snelling, Minn., 9.71; New Haven, Conn., 9.50; St. Joseph, Mo., 9.55; St. Paul, Minn., 9.32; Sidney, Neb., 8.7<sup>c</sup>; Monticello, Iowa, 8.66; Charlotte, N. C., 8.64; Mt. Vernon, Iowa, 8.50; Nashville, Tenn., 8.47; North Platte, Neb., 8.47; Forsyth, Ga., 8.23; Fort McPherson, Neb., 8.14; Pittsburgh, Pa., 7.78.

*Smallest Monthly Rain-falls.*—Over an extensive area, embracing the largest parts of California, Nevada, Utah and portion of the Rio Grande valley, and included within lines marked 0.00 on Chart No. III, numerous reports show that no precipitation occurred. A trace or 0.01 inch was reported at San Francisco, Cal., Winnemucca, Nev., Burkes, Ariz., Boise City, Idaho, Fort McDermit, Austin, Nev., and Brackettville and Uvalde, Texas; 0.02 at Willows, Cal.; 0.04 at Red Bluff, Cal., Fort McKavett, and Edinburg, Tex.; 0.05 at St. George, Utah; 0.07 at Salt Lake City, Utah; 0.10 at St. Mary's Wyo; 0.12 at San Antonio, and 0.14 at Eagle Pass, Tex.

*Rainy Days.*—The number of days on which rain or snow has fallen varies as follows: New England, 9 to 19; Middle Atlantic States, 8 to 14; South Atlantic States, 6 to 17; Gulf States, 6 to 22; Western Texas, 1 to 5; Tennessee and the Ohio valley, 6 to 14; Lower Lakes, 7 to 16; Upper Lakes, 6 to 21; Upper Mississippi valley, 7 to 15; Missouri valley, 10 to 15; Red River of the North valley, 6 to 18; Eastern Rocky Mountain Slope, 3 to 14; Rocky Mountains, 5 to 18; Pike's Peak, 20; Western Plateau, 1 to 6; California, 0 to 2; Oregon, 5 to 8.

*Cloudy Days.*—The number of days on which cloudiness averaged eight-tenths is as follows: New England, 5 to 17; Middle Atlantic States, 4 to 9; South Atlantic States, 4 to 12; Gulf States, 2 to 15; Ohio valley and Tennessee, 4 to 7; Lower Lakes, 3 to 12; Upper Lakes, 1 to 12; Upper Mississippi valley, 2 to 8; Missouri valley, 3 to 8; Red River of the North valley, 5 to 6; Eastern Rocky Mountain Slope, 0 to 11; Rocky Mountain stations, 0 to 7; Western Plateau, 0 to 2; California, 0 to 3; Oregon, 3 to 10.

*Hail.*—The largest numbers of hail-storms reported from a single station are twelve from Pike's Peak, and seven from Fort Wallace, Kan. The only occasion on which hail seems to have been general to any extent, appears to have been in connection with severe local storms of the 16th, when hail was reported from Central New York eastward, to include the greater part of Massachusetts and parts of Rhode Island and Connecticut. The largest hail in Ulster Co., N. Y., where "ice fell in chunks" and at Lanesborough, Mass., where stones seven inches in circumference fell, occurred in connection with these storms. Near Madison, Wis., on 6th, "size of man's fist, killing yearling pigs, &c." No such storms have been reported from either the Gulf States, South Atlantic States, Tennessee, Southeastern Rocky Mountain slope, or Pacific coast. In the Plateau districts it fell only at Fort Douglass, Utah and El Paso, Texas. Only six stations report more than one storm.

*Snow.*—Red Bluff, Cal., reports a light snow-fall on one part of the coast range on the 31st. A few flakes fell at Portland, Me., on the 4th, followed by a shower of rain, temperature above 50°. 4th, on Salmon Mountain, Cal., elevation 6,200 feet.

*Droughts.*—The most extensive and serious droughts of the month are reported from Maryland, Virginia, Texas, Utah, and Nevada. In Maryland and Virginia droughts covering the greatest part of the latter and a considerable portion of the former State were reported to have seriously injured the crops, and in Virginia it was said to have been worst known in twenty years. It terminated on the 26th, since which time copious rains have generally fallen. In the central part of Texas, from the Rio Grande to Red rivers, serious droughts have prevailed during the entire month which have nearly ruined the crops and killed much stock. In the section of country lying between the Rio Grande and Colorado rivers the suffering has been the greatest; all the small streams have gone dry and water holes dried up. In consequence, large numbers of cattle are reported dying in the valley of the Rio Grande, and the crops are utter failures. At Pioche, Nev. and Deep Creek, Utah, it was yet severe at the end of the month.

*Floods and Waterspouts.*—9th, heavy mountain floods reported near Socorro, N. M.; severe local flood at Monticello, Iowa. On the 15th, heavy thunder-storm, with waterspout near Buffalo station, 30 miles south of Denver, Col.; several large buildings carried away, and the bed of the railroad was seriously

damaged by washouts: very heavy rain caused flood at Yankton, carrying away railway bridges and tracks; 16th, local flood, doing considerable damage to low-buildings and railroad tracks at Toledo, O.; 19th, cloud-burst ten miles south of Yreka, Cal.; 20th, serious washouts on Union Pacific Railroad reported near North Platte; 21st, Nora Springs, Iowa, waterspout; 26th, waterspout on divide north of Colorado Springs, carried away bridges and caused serious washouts on railway: serious flood near Pittsburgh, swept away twenty-five buildings, (near Petrolia, Pa.,) several bridges and many miles of railway track; seven inches of rain reported from Irwin, Pa., estimated damage, \$300,000.

## RELATIVE HUMIDITY.

The percentages of mean Relative Humidity for the month range as follows: New England, 60 to 81; Middle Atlantic States, 60 to 80; South Atlantic States, 63 to 82; Gulf States, 57 to 79; Ohio-valley and Tennessee, 57 to 70; Lower Lakes, 64 to 70; Upper Lakes, 67 to 72; Upper Mississippi valley, 61 to 73; Lower Missouri valley, 67 to 71; Red River of the North valley, 72 to 75; Eastern Rocky Mountain Slope, 21 to 81; Rocky Mountain stations, 38 to 50; Western Plateau, 13 to 34; California, 33 to 78; Oregon, 61 to 65; Arizona, 27 to 43. *High stations* report the following averages, not corrected for altitude: Mt. Washington, 86.4; Pike's Peak, 50.7.

## WINDS.

The prevailing winds, at the Signal Corps stations, are shown by the arrows flying with the wind on chart No. II. The *maxima velocities* per hour have been given in the descriptions of movements of areas of low pressure.

*Total Movements of the Air.*—The following are the *largest* monthly movements in miles recorded at the Signal Corps stations:—Mount Washington, 20,152 miles; Cape Lookout, 13,200; Cape Hatteras, 11,129; Kittyhawk, 10,573; Dodge City, 9,725; Wood's Holl, 9,407; Pike's Peak, 9,239; Indianola, 8,949; Sandy Hook, 8,713; Smithville, 8,694; Cape May, 8,268; Breckenridge, 7,586. The *smallest* movements are:—La Mesilla, 1,593 miles; Tucson, 1,806; Nashville, 1,911; Silver City, 1,941; Florence, 2,039; Lynchburg, 2,199; Indianapolis, 2,634; Augusta, Ga., 2,755; Olympia, 2,785; Morgantown, 2,810; Cairo, 2,886.

*Local Storms*—During the month local storms have been numerous and occasionally quite severe. Those notable for *heavy rain* or *hail* will be found under the respective headings. The following is a summary of those accompanied by high or destructive winds: On the 2nd severe local storms occurred in Dakota, Minnesota, Iowa and Wisconsin, preceding low pressure area No. I, as follows: At Elkhorn, D. T., 5.30 p. m., tornado from SW. to SE. in circular course, destroying buildings, &c; the storm in Goodhue Co., Minn., Wednesday night and Thursday morning (2nd—3rd) seemed to start four miles beyond Vasa, the place of greatest destruction, and traveled toward the SW., nine persons killed and thirty injured; at Lake Emily five persons injured, considerable stock killed, granary lifted from foundation and carried 80 feet distant—storm crossed the Mississippi river at Red Wing into Pierce Co., Wis.; at Warrenton a "house was carried away, and four persons who were in it were drowned while attempting to escape, the house being flooded several feet deep;" persons were killed by lightning at Winnebago and Mountain Lake, and "every town in S. and E. part of Wisconsin suffered severely;" a "terrible" wind storm is also reported in northern part of Plymouth Co., Iowa, between 6 and 7 p. m., destroying houses and killing two men; the storm cloud was observed from Lemars, and is described as "having the appearance of an hour-glass, after which it assumed a straight column, and then seemed to break into fragments and drift away; it was in sight about half an hour. On the 6th "violent" NW. wind storm at Logansport, Ind. On the 10th and 11th severe storms accompanied low area No. III in Michigan, Ontario, Ohio, Pennsylvania, New York and Maryland as follows: 11th, Thornville, Lapeer Co., Mich., "hurricane," many buildings demolished, and in adjoining town two persons killed; at Port Huron "heaviest wind ever recorded here; numerous buildings unrooted and trees blown down, all lying from W. to E.; Sardinia, Ontario, noon, terrific storm, "apparently from across the river, in the direction of Port Huron, lasting 15 minutes, doing much damage to buildings and crops;" Sandusky, max. vel. of wind for 10 minutes, 72 miles per hour; Logan Co., Ohio, perfect hurricane in southwestern part of county, buildings damaged and stock killed, track seven miles wide and ten long, one man killed by lightning; Maumee valley, much damage to houses and trees; Erie Co., destructive storm at 3 p. m., lasting five minutes, reported to have alternately touched the ground and then to leave it for a while, general direction of storm towards the southeast, fallen trees generally lying in that direction, but some lying toward the NW.—an observer to the north of the storm states "that a funnel-shaped cloud descended to the ground, rested a moment, and then bounded off; its general appearance was a heavy bank of clouds, reaching to the surface of the ground;" in the Juniata valley, Pa., a storm doing much damage; most destructive at Mifflin, one person killed; at Lewistown buildings were blown down. On the 13th, heavy storms are reported to have visited Wrightsville and Hawkinsville, Ga., demolishing buildings, &c. On the 14th, during passage of low area No. IV at Niagara Falls, N. Y., "severe local storm, injuring buildings and trees," and at Wells' River, Vt., 5.45 p. m., "violent hail-storm and tornado" lasting fifteen minutes. On the 15th, accompanying low area No. V, severe storms in various parts of Ontario during afternoon, doing great damage to buildings and crops; Montreal, Can., night, severe thunder-storm, one person killed; Binghamton, N. Y., violent storm, one person killed, also one person killed at Skaneateles Falls by lightning. On the 16th, accompany-